HOMEBREW COMPUTER CLUB NEWSLETTER

Robert Reiling, editor □ Post Office Box 626 □ Mountain View, CA 94042

Volume Number 1, Issue 10 December 31, 1975

IN THIS ISSUE

This month Ray Boaz concludes his discussion of displays with the final installment of "Intelligent Display For Microcomputers". He includes a circuit diagram of a selectable octal or hex display that has been constructed and tested.

To bring everyone up to date on local sources of hobbyist computers, parts, P.C. boards, time share services, publications, etc. a list of local sources is presented on page 2. These organizations are interested in the hobbyist and it is expected that they will be responsive to our needs.

Tom Pittman explains a software system for saving 8008 processor status while processing interrupts. Software listings are included for this application.

WANTED FOR FUTURE ISSUES

We need more software discussions and articles. Material such as Tom Pittman's article in this issue would be of wide interest. Particularly ALTAIR routines that you have developed and tested could be used by many people in the club. Of course hardware material is welcome too. Send your material to Robert Reiling, editor, P.O. Box 626, Mountain View, CA 94042.

MEETING DECEMBER 10, 1975

Over 200 computer hobbyists at this meeting. Everyone wanted a copy of INTERFACE Volume 1, Issue 1 which was sold for $1.00; $.50 to the HCC and $.50 to the SCCS. An auction was held to sell back panel boards donated by Processor Technology Corp. and to sell a MC6860 modem chip donated by Dan Sokol. A great deal of information was exchanged during the discussion periods. A very helpful meeting.

NEXT MEETING JANUARY 7, 1976

The next meeting is January 7, 1976 at Stanford Linear Accelerator Center, Menlo Park, CA. The meeting begins about 7:00PM. Ask the guard for directions to the meeting room. Processor Technology Corp. is donating a 2KRO PC board kit for the ALTAIR 8800 or IMSAI 8080. It has 1702As programmed with bootstrap loader for ALTAIR 8K BASIC and Intel hex format bootstrap. Valued at $70.00 this kit will be raffled off during the meeting. See you at the meeting.

LOCAL SOURCES OF COMPUTERS, PARTS, P.C. BOARDS, SERVICES, ETC.

At each HCC meeting many of those attending are there for the first time. Some have little knowledge of how or where to get started in a home computer hobby. To aid those interested in a hobby system the HOMEBREW COMPUTER CLUB NEWSLETTER has prepared a list of local sources. Recommendations for additions to this list as well as comments on these suppliers are invited.

BYTE SHOP COMPUTER STORE
1063 El Camino Real
Mountain View, CA 94040
(415)969-5464
ALTAIR products

CALL COMPUTER
1961 Old Middlefield Road
Mountain View, CA 94043
(415)964-5331
Time Share Service, K200 Account

COMPUTER KITS, INC.
1044 University Ave.
Berkeley, CA 94710
(415)845-5300
ALTAIR products

GODBOUT ELECTRONICS
Box 2355
Oakland Airport, CA 94614
(415)357-7007
Parts, IC's, Kits

HALTED ELECTRONICS
729 E. Evelyn Ave.
Sunnyvale, CA 94086
(408)732-1573, (415)969-1448
Surplus items

HALTEK ELECTRONICS
1060 Linda Vista
Mountain View, CA 94040
(415)969-0510
Surplus items

IMS ASSOCIATES INC.
1922 Republic Ave.
San Leandro, CA 94577
(415)483-2093
IMSAI products

INTERNATIONAL ELECT. UNLIMITED
P.O. Box 1708
Monterey, CA 93940
(408)659-3171
Parts

JAMES ELECTRONICS
P.O. Box 822
Belmont, CA 94002
(415)592-8097
Parts, IC's, Kits

M&R ENTERPRISES
P.O. Box 1011
Sunnyvale, CA 94088
(408)738-3772
Parts, IC's, Kits

MICROCOMPUTER ASSOCIATES INC.
111 Main Street
Los Altos, CA 94022
(415)941-1977
JOLT products

PEOPLE'S COMPUTER COMPANY
P.O. Box 310
Menlo Park, CA 94025
(415)323-6117
Newspaper, Publications

PROCESSOR TECHNOLOGY CORP.
2465 Fourth Street
Berkeley, CA 94710
(415)549-0857
Kits

RGS ELECTRONICS
3650 Charles Street
Santa Clara, CA 95050
(408)247-0158
Kits

SOLID STATE MUSIC
2102A Walsh Ave.
Santa Clara, CA 95050
(408)246-2707
Parts, IC's, Surplus items

INTELLIGENT DISPLAY FOR MICROCOMPUTERS - Ray Boaz

In the last two Newsletters circuits for multiplexed display of octal (Issue #8) and hexadecimal (Issue #9) 16 bit address and 8 bit data busses have been presented, in this issue a circuit which is selectable octal or hex is described. As with most true homebrew computers the main goal is low cost, which usually means the minimum parts and the cheapest parts to do the job. The cost trade-off in either multiplexing or direct drive of displays follows the general rule-if more than five digits are used it cost less to multiplex them. This circuit is in response to several requests, it has been constructed, and operates as shown.

Since some digits must be shared for octal and hex, the first thing to set up is the arrangement of the display. This is arbitrary but must be determined for the design of the digit enables. Fig. 1, is how I set it up. All digits are shown with the maximum reading and the shared digits are split to show octal and hex. The numbers above each digit are the counter states which enables that digit.

As before, the counter runs the show and keeps everything in sync. A 74161 (U1) synchronous, presetable, 4 bit binary counter is used in a Reset (R) mode for octal display and in a preset (L-load) mode for hex. Since 15 states are required (9 for octal and 6 for hex) counter states 0 to 8 are used for octal and 10 to 15 for hex, with state 9 detected for reset. Switch S1 causes the counter to either reset to 0000 or preset to 1010. The reset is asynchronous so that the counter goes to 0000 as soon as state 1001 (9) is detected by U9B. However, the L mode is synchronous and loads the counter with 1010 on the next leading edge of the clock after Co goes high, giving a full state time at state 1111. In either case the counter simply counts on from R or L. This gives the 15 unique states required, 12 of which must be OR'd for the shared digits. Counter outputs A,B,C, and D go to like inputs on U2, U3, U4, and U7. On U5 the inputs are A,B, and C, but D must be inverted and goes to the E input, which holds its output low during octal states 0 to 7. During octal state 8 input 0 of U5 is enabled, but since it is grounded its output is again low, just as required.

Except as above, the data multiplexers U2, U3, U4 and U5 operated in a straight forward manner. Each of the 24 inputs to the data mux must be used twice, the arrangement of these inputs is shown in Table 1. The octal and hex inputs are marked as such inside the data muxes on the logic diagram. All four data muxes are enabled during the hex times but U5 is disabled during octal states 0 to 7 by counter output D being inverted and connected to the E input. The setting of S1 determines the counter mode and, therefore, the set of inputs selected by the data muxes. U2, U3, and U4 have only inverted outputs so they must be inverted by U8-A,B, and C.

The digit decoder, U7, simply activates its outputs corresponding to the binery code on its inputs. To make some digits do double duty, two outputs on U7 are OR'd together by use of two resistors and a transistor (same as an RTL OR gate) which can pass the current required for all segments of a digit. An example is: U7 outputs 2 and 10 OR'd to turn on digit 3 at counter states 2 and 10, which correspond to octal A9 on input 2 of U2 and hex A12 on input 10 of U2. Table 1 shows exactly this. The other shared digits operate the same way.

The segment decoder/driver, U6, is the same as used in the hex circuit and works well for both octal and hex display. Hex display for B is b and for D is d. The segment resistors determine the brightness of the display and are a low value due to duty cycle of the LED's (each digit is off 8/9 of the time in octal). These segment resistors are connected to the like segment inputs of each LED.

The parts cost of this circuit is less than $25.00 and is about the least number of parts you can get away with and still do the job. If there are any questions or comments on any of the three circuits on multiplexed displays, I will be happy to answer them. Write to the Newsletter P.O. Box.

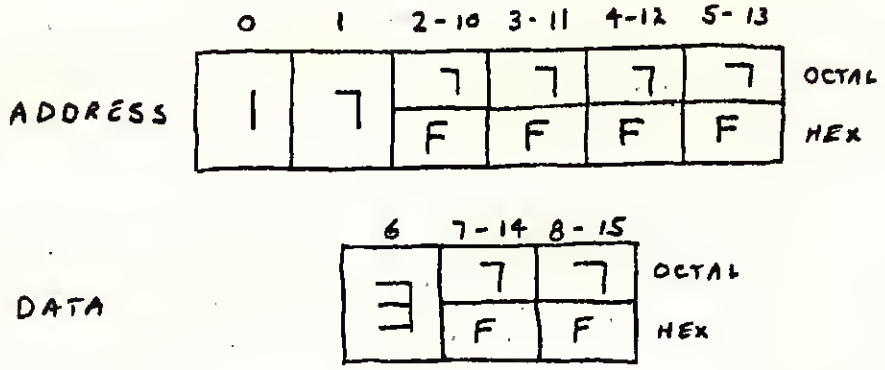


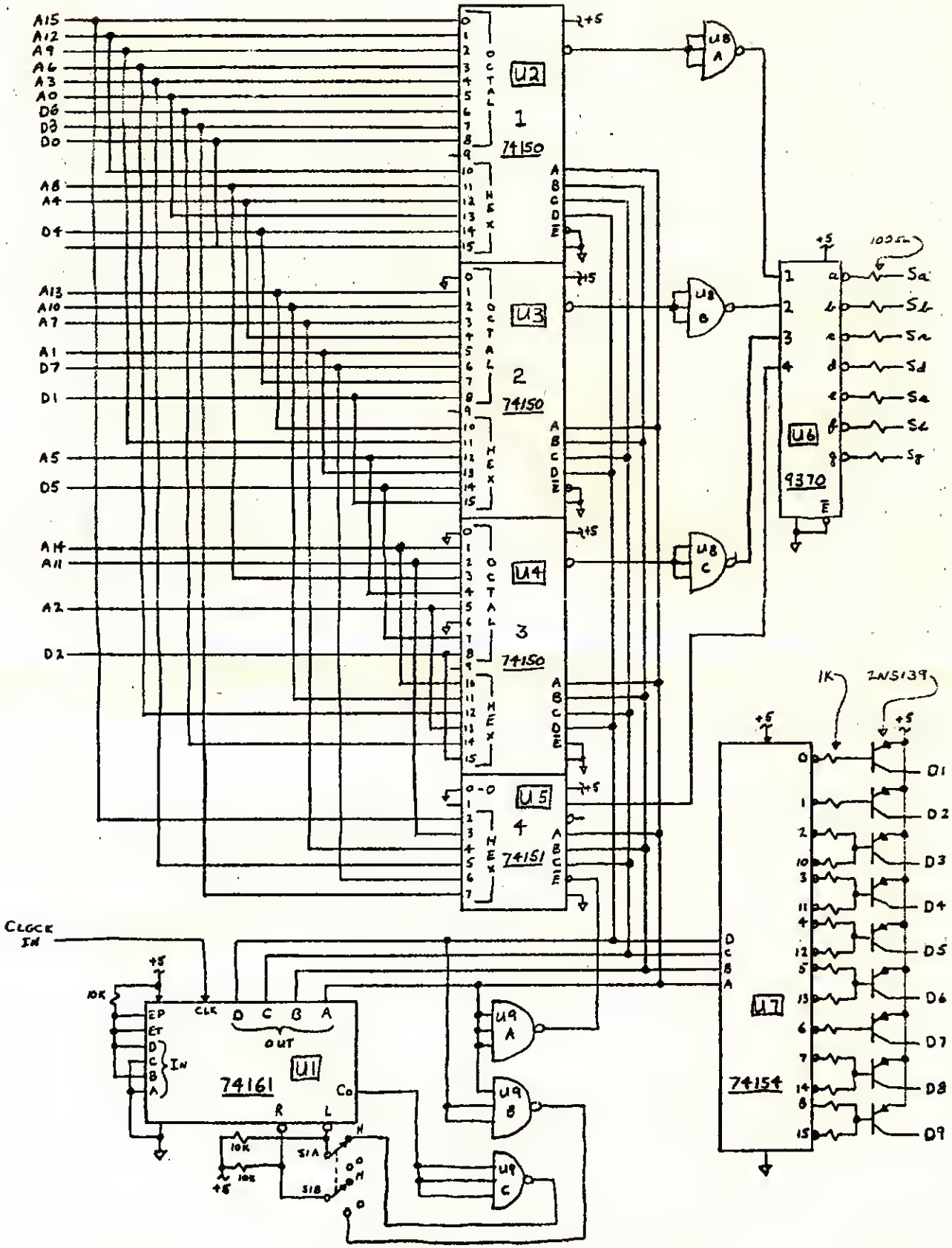
Fig 1.

	ADDRESS												DATA					
COUNTER STATES	0		1		2-10		3-11		4-12		5-13		6		7-14		8-15	
SEGMENT D/D INPUTS	O	H	O	H	O	H	O	H	O	H	O	H	O	H	O	H	O	H
A	A15	—	A12	—	A9	A12	A6	A8	A3	A4	A0	A0	D6	—	D3	D4	D0	D0
B	—	—	A13	—	A10	A13	A7	A9	A4	A5	A1	A1	D7	—	D4	D5	D1	D1
C	—	—	A14	—	A11	A14	A8	A10	A5	A6	A2	A2	—	—	D5	D6	D2	D2
D	—	—	—	—	—	A15	—	A11	—	A7	—	A3	—	—	—	D7	—	D3

TABLE 2.

Microcomputer Interfacing Workshop, March 12-13, 1976. A two-day workshop based on the popular Intel 8080 micro processor. This course is sponsored by the V.P.I. and S.U. Extension Division at the VPI Center in Reston, Va. (near Dulles Airport). This workshop will include many hours of experience in programming and interface construction with over 12 operating microcomputers for participant use. For more information contact Dr. Norris Bell, V.P.I. and S.U. Continuing Education Center, Blacksburg, Va. 24061. 703-951-6328.

Digital Electronics for Automation and Instrumentation, March 21-26 which is a hands-on laboratory/lecture course covering basic digital electronics as well as data communications and interfacing using asynchronous serial techniques. It is held at VPI and SU in Blacksburg, Va. and is sponsored by the American Chemical Society, Education Division, 1155 16th St., N.W., Washington, D.C. 20036 (202)-872-4528.



INTELLIGENT DISPLAY FOR MICROCOMPUTERS

SOFTWARE STACK FOR THE 8008 - Tom Pittman

One of the difficulties with the 8008 has been that there are no built-in facilities for saving the complete processor state while processing interrupts. This problem was corrected in the design of the 8080, but not before many 8008 systems were designed. For the hobbyist with an 8008, two alternatives are open for handling interrupts: An external hardware stack attached to I/O ports (see Byte #2 or my design note in Electronic Design in November 1974); or two CPU registers dedicated to the service of the interrupts.

Dedicating two registers out of the six (non-accumulator) seems a little extravagant, except that with a little care the loss can be minimized by converting the use of those two registers to the support of a software stack, as described here. A software stack can also be used by the main program for temporary data storage without interference by or to the interrupt service routines.

The subroutines shown here dedicate registers D and E to the software stack: these two registers may not be used for any other purpose in the program. However, register E is the stack pointer, and may be incremented or decremented without calling the stack service routines, if it is desired to delete or allocate extra stack space without actually retrieving or storing data. Register D is used only for temporary storage during interrupt service, and should not be used any time an interrupt is possible, since its contents will be destroyed.

The stack is defined to be wholly contained in one page of memory, for a maximum of 256 bytes pushed. The page number is loaded into H with an immediate instruction each time, using the symbolic value PAGE. Before any of the stack routines are called the main program should initialize the E register with the high address of the stack (it pushes downward, like the 8080 stack); E is always considered to point to the next available location. Example:

```
MVI E,255   To use whole page for stack
```

The subroutines may be placed anywhere in memory, but if placed as shown, RST instructions may be used for access (see examples at end of listing). These stack routines are designed to be completely re-entrant; that is, they may be interrupted at any point and called by the interrupt service routines with no loss of data. The status save & restore routines INTS and INTR are not re-entrant since they use the D register; these two routines are designed only for use in servicing the beginning and end of an interrupt, when another is not expected.

BULLETIN BOARD

FOR SALE MARK-8 - 1K words, TV typewriter I and keyboard. Any fair offer considered, because I need the money. John (415)325-1873.

COUPLERS, MODEMS, KEYBOARDS, ETC. - Listing of items for sale with details available. Send SASE to Gary Coleman, 14058 Superior Road Apt. 8, Cleveland, Ohio 44116.

ON LINE - A buy and sell forum for the computer hobbyist. Get details from D. H. Beetle, Publisher, 24695 Santa Cruz Hwy., Los Gatos, CA 95030.

INTERESTED IN GROUP BUY OF INEXPENSIVE LINE PRINTER, or some suitable print mechanism in the $100 to $400 range. Need suggestions and interested people. A. G. Gonzalez, Box 6167, Stanford, CA 94305.

```
                ;   SOFTWARE STACK SUBROUTINES FOR 8008
                ;
0010            PAGE    SET     16      ; PAGE IN RAM OF STACK
0000                    ORG     40      ; FOR USE AS RST 5
0028 C0                 NOP
0029 C0                 NOP
                ;
                ;   STACK PUSH  (RE-ENTRANT)
                ;
002A 2E10       PUSH:   MVI     H,PAGE  ; SET PAGE OF STACK
002C F4                 MOV     L,E     ; GET POINTER
002D 21                 DCM     E       ; DECREMENT STACK POINTER
002E F8                 MOV     M,A     ; STORE A IN STACK
002F 07                 RET
                ;
                ;   STACK POP  (RE-ENTRANT)
                ;
0030 2E10       POP:    MVI     H,PAGE  ; SET PAGE OF STACK
0032 F4                 MOV     L,E     ; GET POINTER
0033 30                 INR     L       ; POINT TO STACK TOP
0034 C7                 MOV     A,M     ; FETCH IT INTO A
0035 E6                 MOV     E,L     ; UPDATE STACK POINTER
0036 30                 INR     L       ; LEAVE L AT STACK TOP
0037 07                 RET
                ;
                ;   EXCHANGE A WITH STACK TOP  (RE-ENTRANT)
                ;
0038 2E10       XCHA:   MVI     H,PAGE  ; SET PAGE OF STACK
003A F4                 MOV     L,E     ; GET POINTER
003B 21                 DCR     E       ; DECREMENT STACK POINTER
003C F8                 MOV     M,A     ; SAVE OLD A
003D 30                 INR     L       ; POINT TO OLD TOP
003E C7                 MOV     A,M     ; FETCH IT
003F F4                 MOV     L,E     ; PUSH INTO STACK,
0040 21                 DCR     E       ; (AT NEW TOP)
0041 F8                 MOV     M,A
0042 30                 INR     L       ; RETRIEVE OLD A
0043 C7                 MOV     A,M
0044 30                 INR     L       ; STORE IN OLD TOP
0045 F8                 MOV     M,A
0046 31                 DCR     L       ; RECOVER NEW A
0047 31                 DCR     L
0048 C7                 MOV     A,M
0049 30                 INR     L       ; DISCARD TEMP CELLS
004A E6                 MOV     E,L     ; AT STACK TOP
004B 30                 INR     L       ; LEAVE L AT STACK TOP
004C 07                 RET
                ;
                ;   PUSH A,H,L, & FLAGS INTO STACK
                ;
004D D8         INTS:   MOV     D,L     ; SAVE L IN (DEDICATED) D
004E F4                 MOV     L,E     ; GET STACK POINTER
004F E5                 MOV     E,H     ; SAVE H IN E
0050 2E10               MVI     H,PAGE  ; SET PAGE OF STACK
0052 F8                 MOV     M,A     ; PUSH A
0053 0680               MVI     A,0     ; ENCODE FLAGS:
0055 685F00             JZ      $+10    ;   ZERO
0058 06A0               MVI     A,160   ;   NONZERO
005A 705F00             JM      $+5     ;   MINUS
005D 0660               MVI     A,96    ;   PLUS
005F 1A                 RAR             ;   CARRY (SHIFTED IN)
0060 786500             JPE     $+5     ;   EVEN PARITY
0063 3408               ORI     8       ;   ODD PARITY
0065 31                 DCR     L       ; PUSH INTO STACK
0066 F8                 MOV     M,A
0067 31                 DCR     L       ; NOW PUSH H
0068 FC                 MOV     M,E     ; (WAS IN E)
0069 31                 DCR     L       ; *PUSH L*
006A FB                 MOV     M,D     ; *REQUIRED ONLY IF NESTED*
006B E6                 MOV     E,L     ; PUT STACK POINTER
006C 21                 DCR     E       ; BACK INTO E
006D 07                 RET
                ;
                ;   POP A,H,L, & FLAGS FROM STACK
                ;
006E 2E10       INTR:   MVI     H,PAGE  ; SET PAGE OF STACK
0070 F4                 MOV     L,E     ; GET POINTER
0071 30                 INR     L
0072 DF                 MOV     D,M     ; *POP L VALUE INTO D*
0073 30                 INR     L       ; *OMIT IF NOT PUSHED*
0074 E7                 MOV     E,M     ; POP H VALUE INTO E
0075 30                 INR     L
0076 C7                 MOV     A,M     ; POP FLAGS INTO A
0077 30                 INR     L
0078 80                 ADD     A       ; SET FLAGS
0079 C7                 MOV     A,M     ; POP A FROM STACK
007A EC                 MOV     H,E     ; RE-ARRANGE REGISTERS:
007B E6                 MOV     E,L     ; STACK POINTER TO E FROM L
007C F3                 MOV     L,D     ; H&L FROM E&D
007D 07                 RET
                ;
                ;   EXAMPLES OF USE:
                ;
007E 462800             CALL    PUSH    ; TO PUSH A
                ;
0081 2D                 RST     5       ; TO PUSH A
                ;
0082 463000             CALL    POP     ; TO POP A
                ;
0085 35                 RST     6       ; TO POP A
                ;
0086 463800             CALL    XCHA    ; TO EXCHANGE A WITH TOP
                ;
0089 3D                 RST     7       ; TO EXCHANGE A WITH TOP
                ;
008A C8                 MOV     B,A     ; TO EXCHANGE A WITH TOP,
008B 35                 RST     6       ; BUT 30% FASTER:
008C 2D                 RST     5       ; ALSO CLOBBERS REGISTER B.
008D F9                 MOV     M,B
                ;
008E 2D                 RST     5       ; TO PUSH B
008F F9                 MOV     M,B
                ;
0090 35                 RST     6       ; TO ADD TOP TWO BYTES
0091 87                 ADD     M       ; FROM THE STACK,
0092 F8                 MOV     M,A     ; AND LEAVE SUM ON STACK
```

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